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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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M. David Galin
Renner, Otto, Boisselle & Sklar, LLP
Nineteenth Floor
1621 Euclid Avenue,
Cleveland, OH 44115

EXAMINER

QUINTO, KEVIN V

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/044,493

Applicant(s)

YU ET AL.

Examiner

Kevin Quinto

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 December 2003.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10,20 and 21 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-10,20 and 21 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, filed December 5, 2003, with respect to the rejection(s) of claim(s) 1-10 and 20 under 35 USC § 102, 112, and 103 have been fully considered and are persuasive. Therefore, the rejections have been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the newly cited references discussed below.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claim 5 recites the limitation "the high-K material" in the first and second lines. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 2, 5, 9, 20, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (USPN 6,303,479 B1) in view of Ma et al. (USPN 6,060,755) and further in view of Liu et al. (USPN 6,590,271 B2).

7. In reference to claims 1, 2, and 5, Snyder (USPN 6,303,479 B1, hereinafter referred to as the "Snyder reference") discloses a similar device. Figure 9 of Snyder discloses a semiconductor device (904 or 905) with a source and a drain (904 or 905) consisting essentially of silicide. A semiconductor body is disposed between the source and the drain (904 or 905). There is a gate electrode (906 or 907) which is disposed over the body; it is understood that the gate electrode (906 or 907) defines a channel between the source and the drain (904 or 905). A gate dielectric separates the gate electrode (906 or 907) from the body. The examiner notes that the applicant has stated that titanium oxide, zirconium oxide, and barium strontium titanate each have a relative permittivity of 10 or more (p. 4 of specification, lines 18-29). Snyder does not disclose the use of a gate dielectric with a relative permittivity greater than 10. However the use of such high dielectric constant materials as the gate insulating film is well known in the art. Ma et al. (USPN 6,060,755, hereinafter referred to as the "Ma" reference) discloses that a gate insulating film made of high dielectric constant materials, such as titanium oxide and barium strontium titanate, allows smaller devices to be built (column 1, lines 13-30). Liu et al. (USPN 6,590,271 B2, hereinafter referred to as the "Liu" reference) discloses that smaller devices are desirable in the art (column 1, lines 15-22). In view of

Ma and Liu, it would therefore be obvious to use either titanium oxide, zirconium oxide, or barium strontium titanate as the gate dielectric of Snyder.

8. With regard to claim 9, there is a liner which is disposed adjacent sidewalls defined by the gate electrode (906 or 907) and the gate dielectric.

9. In reference to claim 20, Snyder (USPN 6,303,479 B1) discloses a similar device. Figure 9 of Snyder discloses a semiconductor device (904 or 905) with a source and a drain (904 or 905) consisting essentially of silicide. A semiconductor body is disposed between the source and the drain (904 or 905). A source/body junction is defined by silicide material of the source and semiconductor material of the body. A drain/body junction is defined by silicide material of the drain and semiconductor material of the body. There is a gate electrode (906 or 907) which is disposed over the body; it is understood that the gate electrode (906 or 907) defines a channel between the source and the drain (904 or 905). A gate dielectric separates the gate electrode (906 or 907) from the body. The examiner notes that the applicant has stated that titanium oxide, zirconium oxide, and barium strontium titanate each have a relative permittivity of 10 or more (p. 4 of specification, lines 18-29). Snyder does not disclose the use of a gate dielectric with a relative permittivity greater than 10. However the use of such high dielectric constant materials as the gate insulating film is well known in the art. Ma (USPN 6,060,755) discloses that a gate insulating film made of high dielectric constant materials, such as titanium oxide and barium strontium titanate, allows smaller devices to be built (column 1, lines 13-30). Liu (USPN 6,590,271 B2) discloses that smaller devices are desirable in the art (column 1, lines 15-22). In view of Ma and Liu, it would

therefore be obvious to use either titanium oxide, zirconium oxide, or barium strontium titanate as the gate dielectric of Snyder.

10. In reference to claim 21, Snyder (USPN 6,303,479 B1) discloses a similar device. Figure 9 of Snyder discloses a semiconductor device (904 or 905) with a source and a drain (904 or 905) consisting of silicide. A semiconductor body is disposed between the source and the drain (904 or 905). There is a gate electrode (906 or 907) which is disposed over the body; it is understood that the gate electrode (906 or 907) defines a channel between the source and the drain (904 or 905). A gate dielectric separates the gate electrode (906 or 907) from the body. The examiner notes that the applicant has stated that titanium oxide, zirconium oxide, and barium strontium titanate each have a relative permittivity of 10 or more (p. 4 of specification, lines 18-29). Snyder does not disclose the use of a gate dielectric with a relative permittivity greater than 10. However the use of such high dielectric constant materials as the gate insulating film is well known in the art. Ma (USPN 6,060,755) discloses that a gate insulating film made of high dielectric constant materials, such as titanium oxide and barium strontium titanate, allows smaller devices to be built (column 1, lines 13-30). Liu (USPN 6,590,271 B2) discloses that smaller devices are desirable in the art (column 1, lines 15-22). In view of Ma and Liu, it would therefore be obvious to use either titanium oxide, zirconium oxide, or barium strontium titanate as the gate dielectric of Snyder.

11. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (USPN 6,303,479 B1) in view of Ma et al. (USPN 6,060,755) and further in view

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of Liu et al. (USPN 6,590,271 B2) as applied to claim 1 above and further in view of Wilk et al. (USPN 6,291,282 B1).

12. With regard to claims 3 and 4, Snyder does not disclose the use of a metal gate. However the use of a metal gate is well known in the semiconductor art. Wilk et al. (USPN 6,291,282 B1, hereinafter referred to as the "Wilk" reference) discloses that metal gates (such as tungsten, aluminum, and platinum) have a low sheet resistivity (column 1, lines 49-67 and column 2, lines 1-9). Wilk discloses that gates with low sheet resistivity are desirable in the art (column 1, lines 29-42). In view of Wilk, it would therefore be obvious to use a metal (such as tungsten, aluminum, and platinum) for the gate electrode.

13. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (USPN 6,303,479 B1) in view of Ma et al. (USPN 6,060,755) and further in view of Liu et al. (USPN 6,590,271 B2) as applied to claim 1 above and further in view of Raajimakers et al. (United States Patent Application Publication No. US 2001/0031562 A1).

14. In reference to claims 6 and 7, Snyder does not disclose the use of an oxide buffer layer. However it is well known in the art to provide an oxide buffer layer between a substrate and a high dielectric constant insulating film. Raajimakers discloses that a thin silicon oxide layer improves the interface between silicon and a high dielectric constant film (p.1, paragraph 7 and p.3, paragraph 33). It would therefore be obvious to use an oxide buffer layer in the device of Snyder constructed in view of Ma and Liu so as to attain this benefit. Snyder, Ma, Liu, and Raajimakers teach all of the claimed

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invention except for the exact thickness of the oxide layer. Although Snyder, Ma, Liu, and Raajimakers do not teach the exact oxide thickness as that claimed by Applicant:

The shape, size, dimension differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note In re Leshin, 125 USPQ 416.

Therefore claim 7 is not patentably distinguishable over the Snyder, Ma, Liu, and Raajimakers references.

15. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (USPN 6,303,479 B1) in view of Ma et al. (USPN 6,060,755) and further in view of Liu et al. (USPN 6,590,271 B2) as applied to claim 1 above and further in view of Poon et al. ("Thermal stability of cobalt and nickel silicides in amorphous and crystalline silicon," Proceedings of Electron Devices Meeting, 1997, p. 65-68).

16. In reference to claim 8, Snyder uses rare earth metal silicides for the source and drain but does not explicitly disclose the use of nickel silicide for the source and drain. However the use of nickel silicides is well known in the art. Poon et al. ("Thermal stability of cobalt and nickel silicides in amorphous and crystalline silicon," Proceedings of Electron Devices Meeting, 1997, p. 65-68, hereinafter referred to as the "Poon" reference) discloses that nickel silicide has the advantages of good thermal stability, a low formation temperature and a single step anneal (abstract). In view of Poon, it would therefore be obvious to use nickel silicide in the device of Snyder.

17. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (USPN 6,303,479 B1) in view of Ma et al. (USPN 6,060,755) and further in view of Liu et al. (USPN 6,590,271 B2) as applied to claim 1 above and further in view of Venkatesan et al. (USPN 5,736,435).

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18. In reference to claim 10, Snyder does not disclose the use of an SOI substrate (a semiconductor film disposed on an insulating layer, the layer being disposed on a semiconductor substrate). However the use of an SOI substrate is well known in the art. Venkatesan et al. (USPN 5,736,435, hereinafter referred to as the "Venkatesan" reference) discloses that SOI provides the advantages of reduced junction capacitance, large drive currents, high transconductance values, and immunity to short channel effects (column 1, lines 35-55). It would therefore be obvious to construct the device of Snyder on an SOI substrate so as to attain these benefits.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (571) 272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KVQ



NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800